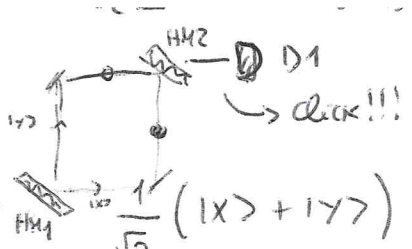
$|x\rangle \mapsto \frac{1}{\sqrt{2}}(|x\rangle + |y\rangle)$

$|y\rangle \mapsto \frac{1}{\sqrt{2}}(|x\rangle - |y\rangle)$



$|x\rangle \mapsto \frac{1}{\sqrt{2}}(|x\rangle + |y\rangle) \mapsto \frac{1}{\sqrt{2}}(|y\rangle + |x\rangle) \rightarrow$

$\rightarrow \frac{1}{\sqrt{2}}\left(\frac{1}{\sqrt{2}}(|x\rangle - |y\rangle)\right) + \frac{1}{\sqrt{2}}(|x\rangle + |y\rangle) = |x\rangle$!!

$=$

Now, let us put a bomb... and see it in two ways:

if the bomb is fake $\mapsto$ nothing happens! only in D1, it makes click.

if the bomb is true:

$\rightarrow$ only $|y\rangle$ survives.... then you hear boom... ciao bomb...
50%

$\rightarrow$ only $|x\rangle$ survived... the bomb does not explode
50%

$\rightarrow$ But then, what does it happen on HM2?

$|x\rangle \mapsto \frac{1}{\sqrt{2}}(|x\rangle + |y\rangle)$ $\begin{cases} \rightarrow 25\%$ click on $D_1 \mapsto$ "bad" INFO
$\hookrightarrow 25\%$ click on $D_2 \mapsto$ "bad" INFO

But, again, we do not need the colors....

Let us simply put the bomb off in the game.

$$|x\rangle \mapsto \sqrt{\tfrac{1}{2}}\,(|x\rangle + |y\rangle) \mapsto \frac{1}{\sqrt{2}}(|y\rangle + |x\rangle)$$

$$\xrightarrow{\text{Bomb}} \frac{1}{\sqrt{2}}\left(|y\rangle|B\text{-}E\rangle + |x\rangle|B\text{-}NE\rangle\right)$$

$$\mapsto \sqrt{\tfrac{1}{2}}\left(\sqrt{\tfrac{1}{2}}\,(|x\rangle - |y\rangle)\,|B\text{-}E\rangle + \sqrt{\tfrac{1}{2}}\,(|x\rangle + |y\rangle)\,|B\text{-}NE\rangle\right)$$

$$= \frac{1}{2}(|x\rangle - |y\rangle)\,|B\text{-}E\rangle + \frac{1}{2}(|x\rangle + |y\rangle|B\text{-}NE\rangle$$

Then, we have simple:

$\frac{1}{4} = 25\%$ D1 click, B-explodes...

$\frac{1}{4} = 25\%$ D2 click, B explodes

...

...

Reduce $\mathcal{C}$...

↳ see next page!!

Note, we can also model the "absorption of the σ":

$$|x\rangle \mapsto \sqrt{\tfrac{1}{2}}\left(|B\text{-}E\rangle + |x\rangle|B\text{-}NE\rangle\right) =$$

$$\mapsto \sqrt{\tfrac{1}{2}}|B\text{-}E\rangle + \sqrt{\tfrac{1}{2}}\left(\sqrt{\tfrac{1}{2}}(|x\rangle + |y\rangle)\right)|B\text{-}NE\rangle$$

50% B-E, no click.

25% BnE, click D_1

25% BnE, click D_2

This is the why $\langle BE|B\text{-}NE\rangle = 0$!!!!!

What obs. reduced $\rho_{RED} = \langle B\text{-}E|\rho|B\text{-}E\rangle + \langle B\text{-}NE|\rho|B\text{-}NE\rangle =$

with $\rho = \rho_{RED} = \frac{1}{2}|x\rangle + \frac{1}{2}|y\rangle$

in block: $\langle B\text{-}E|\rho\rangle = \left(\frac{1}{2}|x\rangle - |y\rangle\right)\left(\frac{1}{2}\langle x| - \langle y|\right) + \left(\frac{1}{2}|x+y\rangle\right)\left(\frac{1}{2}\langle x| + \langle y|\right)$

$$= \frac{1}{2}|x\rangle\langle x| + \frac{1}{2}|y\rangle\langle y|$$

Just 50%, 50%, no interference